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THE PLACE OF STATE ACADEMIES OF SCIENCE AMONG SCIENTIFIC ORGANIZATIONS[1]

DURING the early part and the middle of the last century, when the means of transportation were less abundant than at present, when science was not so highly differentiated and scientific men were not so thoroughly organized, the state academies were at the apex of their influence. Those citizens in the most populous centers of the more progressive states that were interested in science banded together to talk about the new books that were being published abroad, to share with each other their various discoveries, to lend each other specimens, to show each other their collections and to discuss in general the scientific news brought to their attention by travellers. They were—most of them—amateurs whose vocations were along business lines and whose pastime was science. The telescope and the microscope were their instruments of pleasure rather than golf sticks, and the objects of their interest were the minute or the distant, rather than their scores. Scientific knowledge was by them regarded as cultural—to be acquired deliberately and to be dispensed with dignity. They were the chosen among the intellectuals. They were possessors of information that was unattainable to the common herd and he who reached the heights of publication became the elect of the elect. New theories were scanned with awesome wonder and new terms were caressed by the tongue as delightful morsels and the more complex they were the more appetizing they became. Discussions of new views were carried on with warmth and sometimes with heat. Often open meetings were held, when the members explained the mysteries of science to the uninitiated in the subject and incidentally acquired fame. As

[1] Abstract of address delivered before the Wisconsin Academy of Sciences, Arts and Letters and the Wisconsin Archeological Society, at Beloit, Wisconsin, April 6, 1923.

the fashion of speech in those days was oratorical there was much in the explanations that the listeners did not understand, but that contributed all the more to the reputation of the speakers—and they and their confreres in the academy were regarded as the "aristocracy of learning."

There were then no professional scientists to commercialize their wisdom, unless we except the few teachers of natural history in the eastern universities and the few government geologists whose travels to and fro among the industrious farmers were looked upon as the wanderings of the unbalanced. The salaries of these men, moreover, were so small that they were never regarded as making their living by science and so were not thought of as following a profession.

The state geologist of North Carolina, for example—the man for whom the loftiest peak in the Appalachians was named—was allowed by the state the munificent sum of $200 for his year's work among the mountains, on condition that he furnish and maintain his own horse. Is it any wonder then that the professional scientist was not regarded as debasing his love for paltry cash! Indeed no scientist in those days exchanged knowledge for money: they were all amateurs in the sense defined by the athletes.

In spite of the fact that the members of the State Academies constituted a caste apart, the societies nevertheless were doing a good work. They were keeping alive the tiny spark of scientific flame that had all but been quenched in the turmoil and stress that attended the making of a nation. There was little time for contemplating nature; most of it was employed in wresting from her the wherewithal to live. Had it not been for the enthusiasts in the academies the populace would have lost all touch with scientific thought.

As the conditions of life became easier and the demand for scientifically trained men arose, the professional scientist developed. At the same time science became more complex and its differentiation into branches followed. Science became technical. It was no longer possible to become familiar with all its ramifications. The demands on the mind were so urgent that few minds were able to accede to those of more than a single branch. The new generation was compelled to specialize. It was not content with the general knowledge of its fathers and as a result the old science groups began to disintegrate. The professional scientists, finding little in the state academies that was thought worthy of their attention, did not fill the places of the older men who were gradually dropping out because of increased age. Thus many of the state academies ceased to function as active bodies. The professional men, as they increased in numbers, formed their own organizations and state academies were neglected. Those that contained a few enthusiasts continued to exist, but rather as social clubs than as scientific groups. Others that had acquired a little collection during their more prosperous days maintained a small museum. A few in the larger states became publishing bodies. But most of them simply became comatose. A few years ago Professor Whitney sent inquiries to all the state academies for the purpose of learning something about their activities. Only twenty-four replied to his questions and of these only eight reported vigorous life; twelve were dormant and four were reported dead.

The question arises, therefore, as to the desirability of maintaining organizations that appear to present so little purpose in their existence. Shall they be allowed to die, or should they be resuscitated with the hope that they may accomplish some work that is not now being undertaken by other agencies?

They can not serve successfully as local technical societies except in the largest states, because their membership is comparatively small and is too divided in interests to furnish groups for discussion and their programs are consequently too dilute to attract many serious students. The interests of science workers are best served by branches of the national societies where there are enough persons of kindred interests to insure free discussion. In some states and in groups of neighboring states we already see the mathematicians and other specialists attending their own meetings and neglecting those of the state academies and with an increase in the density in population this tendency to "flock together" will be intensified. The result of this tendency is that the meetings of the

academies are becoming labored, with the younger academicians refusing to contribute to the program because of modesty, since they can not hope to add much to the general store of knowledge, and the older members saving their best efforts for their technical societies. The state academies can not successfully become little "National Societies" for the reason given, nor should they try to do so because that would mean a duplication of work and consequently a waste of energy.

We often hear the wish expressed that the state academies might serve the purpose of bringing together in a single meeting scientists with varied interests to discuss matters of general interest to all scientists. In my own opinion this is impossible. Science is now too specialized to furnish many subjects of general conversation. Though we may earnestly wish to become acquainted with the advanced thought in other branches of science than our own, the wish, it seems to me, is impossible of accomplishment because most men are not furnished with the proper mental digestive apparatus for its assimilation.

If, then, the state academies should not attempt to function as little technical societies, how may they function? Is there any place they can occupy to the benefit of science?

In reply to this question there are several suggestions that offer themselves.

(1) They may serve as agencies to encourage the study of local science, *i.e.*, of science applied to the local problems and for the publication of the results of such study.

There are many subjects of local interest that ought to be studied, if for no other purpose than to be recorded, since conditions are changing rapidly. The facts of common knowledge to-day may be forgotten to-morrow. If it is not some one's business to record them, they may be lost forever. Many valuable observations may be made in one's own neighborhood. If the observer is careful and accurate, observations that appear at the time to be trivial may be of fundamental importance to an investigator who may later be engaged in the study of a general problem. The ecological botanist of to-day would welcome results of a careful study of the native prairie flora that had been made at widely separated places at a time before imported plants had become widely spread. Such a study would furnish him with a standard by which he could measure the rate of spread of an introduced flora, or might enable him to determine the influence of a changed environment upon the original plant assemblage. It would have been a comparatively simple piece of work that would not have been beyond the powers of a comparative novice in botany, but it might have supplied data which can not now be obtained. Again, the continuous observation of the action of a little stream in modifying its channel is not a difficult task, but the results obtained might well be of service in helping to explain the action of a big river and might furnish a hint that would aid us in understanding some of the difficulties in the interpretation of erosion processes.

In other words, the careful study of simple phenomena may, in many cases, contribute to the understanding of much more complex ones and the state academies may well charge themselves with the encouragement of such studies. The field is all around us. But the laborers are comparatively few. They might be increased to almost any extent, for

> On every thorn delightful wisdom grows;
> In every rill a sweet instruction flows.

The state academies will justify themselves if they can originate any plan that will enlarge their number.

Although this objective phase of local science study is highly important, the subjective phase is even more important. The influence of any intensive observational study on the mind of the student sharpens his eyes and brightens his wits. His judgment is matured by comparison of his conclusions with those of others observing similar phenomena. This is education and it is this kind of education that differentiates the science student from the students in many other lines. Without it he is destined to be a failure as a scientist, even though fully equipped with book knowledge; with it he may be efficient even though his book knowledge is scanty. Good observers are needed and the best training for accurate observation is through the exercise of the observing faculty. If the state academies can keep the young observer investigating they will be doing much to supply the state with dependable men and women

who can be called upon for service when service of this kind is demanded for the welfare of the community. And the state academies can do a great deal toward this end if they will encourage the young worker to do what he can with the material at hand, will show an appreciation of his attempt to do some little thing in a worth-while way and will welcome his contribution to the general fund of scientific knowledge. If he is accepted as one of the serious workers in his field there will result a reaction in his mind that cannot help but be of benefit to him as a man but also as a scientist.

Perhaps in no other way can the appreciation of a man's work be shown better than by publishing his results. For this reason alone, if for no other, it is important that the academy should publish its proceedings. The appearance of the results of a man's labor in print is in some measure a guerdon of the approbation of his associates—and with the favor of his associates secured, his pride in his work will be increased and his enthusiasm for further work will be assured. Another convert to the religion of work will have been gained.

But the publications of the state academy have another function which they can exercise in such a way as to supplement the activities of the national societies without in the least duplicating effort.

There are many facts of local interest that for their own value are worthy of presentation at meetings of scientific men and many details connected with local scientific discoveries that are worthy of preservation, but which can not be printed in the proceedings of national societies because of lack of space. Some of them at the time of presentation may appear trivial, but trivialities have a habit occasionally of growing into significancies—like the falling apple which Newton is supposed to have noted. An observation may not be profound, but if it is not known to have been made before it is part of wisdom to place it on record. It may fill a gap in a line of reasoning.

Details are often tiresome, but the accumulation of details is necessary to the development of a generalization and the state academy may serve a good purpose to science by placing them also in the record. Thus, by recording facts of local interest and the details of observations, the state academies of science might serve a purpose similar to that served by local historical societies.

On the other hand, it seems desirable to many of us that the practice of printing in the academy transactions lists of species or descriptions of varieties of animals or plants of little interest to any but specialists should be abandoned. It may be of value to know exactly the number and names of the different kinds of moulds that have been discovered on the willows of southern Wisconsin, but the proper place for such a publication is a bulletin of some natural history survey, or perhaps the pages of some technical journal. Not only is it unfair to the members of the academy to expend their contributions on a matter of interest to so few persons, when so many other articles of more general interest are awaiting publication, but it is also unfair to the workers along the line of the publication to encourage the burial of a paper of this type in the midst of a mass of material of such different character. The literature of any branch of science is already so widely scattered that it is a serious undertaking to follow it through all its ramifications. If the academy is to serve science it should discourage every practice that will make more difficult the searching of the literature for highly technical articles and should avoid every tendency to waste the investigator's time. If we could confine the printing of material to the publications in which it is naturally sought, the chances of the scientist to occupy a comfortable berth in the distant future would be greatly increased. It might be well to have it distinctly understood that no paper will be published in the academy proceedings which should not be read before an audience at the general meeting. If the academy succeeds in preventing the appearance on the pages of its proceedings of a valuable article that ought to appear elsewhere it will have done a service to science of no little value.

(2) The state academies may further justify their existence by functioning as educational agencies. The non-scientific citizen gets little accurate knowledge of what science means from the newspapers and little more from the popular magazines. He may become acquainted with

a few facts, but he learns almost nothing of the teachings of science or of its tendencies. The state academies might well attempt to give a sane view of science to the man who is not technically trained and especially to convince him that scientific theories are based on a careful and painstaking search for the truth.

If the majority of the citizens of Oklahoma were convinced that scientific conclusions are not biased and that they are never final, but are constantly being tested as to their correctness, the legislature of the state would never have considered seriously the law forbidding the use in the schools of any text-book suggesting the possible truth of the theory of evolution. If the church membership of Minnesota were a scientifically educated membership its representatives would never have passed the resolutions that gave Van Loon a text from which to write a good-natured comment on their sophistry.

"The histories of H. G. Wells and Hendrik Willem van Loon," say the Minnesota resolutions, "are unworthy of a place in a university class room and unfit for our public schools because they introduce an element of mere speculation as to the origin of man and call it history and use this theory in manifest endeavor to destroy the faith of the students in their creator, God, and their supernatural redeemer."

"Being convinced that such teachings will eventuate in anarchy of government, we citizens urge for immediate assurance that atheistic, rationalistic and materialistic textbooks and teachers shall not be continued in our public schools," etc.

"Everywhere," retorts van Loon in the Baltimore *Sun*, "is the same dispute, based firmly upon ignorance and prejudice.

"Everywhere it is the same story of ill-paid, honest, hard-working scientists threatened with the loss of their livelihood by the illustrious companion of the cat that eats cucumbers and the Seminole saxophone sextet."

It is only by discussion that the truth is made evident. The state academy may perform a great service to the community if it will so arrange its program that a part is annually devoted to a frank statement of the condition of mind of science with reference to some great theory, or some subject of general popular interest. This year the Illinois Academy will devote its entire morning session to a statement of what the "Theory of evolution" is and why it appears to be well founded.

The state academies can do work of this kind better than the technical societies because, being less technical, they can reach a larger audience and, because they always meet in the same general community, they can work the field more thoroughly. Moreover, the speakers at the academy meetings are usually more familiarly known to the citizens of the community than those speaking at the meetings of the national societies. They are fellow citizens whose lives are known to be upright and whose thoughts are known to be normal and who, therefore, are listened to with more sympathy and patience than are the visitors from foreign states, who fill the greater part of the programs at the national society meetings. Moreover, since the audiences at the academy meetings are known to be composed largely of persons who are not technically trained, the speakers are more apt to use in their talks fewer technical terms than is likely to be the case when addressing members of local technical societies. Consequently the state academies occupy a position which, in this respect, is quite different from that of the technical societies and any effort they may exert in educating the public in scientific matters is not a duplication of the efforts of any other agency in the field.

(3) But the state academies may not only serve as educational agencies. They may serve also in a very direct way as training schools for young science teachers and indirectly for their pupils. The academies may by such service greatly advance science.

The future of science depends upon the coming generation and the training of the new generation is entrusted to the young men and women of the present generation. It is important, therefore, that the young teachers be encouraged, not only to impart the proper kind of knowledge to the students under their charge, but also to implant in their minds the means of acquiring new knowledge and to help them to reason on the foundation of facts observed. The teachers should therefore be urged to observe and infer, to experiment and

speculate, in order that they may be the better prepared to lead their pupils along the proper paths.

There are many instructors in our colleges, high schools and normal schools who might contribute a mite to the sum total of scientific knowledge if they felt it worth the effort to do so and at the same time might indirectly instil into the mind of some bright student the desire to do likewise. If they can be persuaded to do the work necessary to learn a new fact or to obtain a new point of view the experience accumulated in the effort will be of immense value to them not only as independent investigators but also as interpreters of the results of other investigators. They will become more interesting teachers, because they will speak with a greater understanding of the significance of the statements made in the textbooks and will often be able to illustrate them with references to their own discoveries. The pupils will consequently be apt to feel that they have a wide-awake teacher who is interested in his subject, rather than one whose interest is mainly in his salary. Impressed with the thought that things worth looking into are actually happening in his vicinity and that there are interesting facts to be discovered about objects that hitherto may have seemed commonplace to him, the normal boy or girl, impelled by his natural curiosity, will want to learn about them. Of course, many will soon tire of this kind of exploration, but some will find it fascinating—and a new scientist will be started on his career.

Certainly a teacher who is not himself a student of nature will never inspire his pupils to become scientific workers—and no teacher can possibly be a student of nature who doesn't study his environment.

I believe the most important function of the state academy is to prevent the science graduate who goes into teaching from becoming a penny-in-the-slot machine for retailing little scraps of knowledge recurrently at the ringing of an electric bell. It is our business as members of the academies to do what we can to prevent dry-rot in our science graduates before they make even an attempt at blooming. Of course, we know that most graduates in science have written theses based on research. But we also know that in most cases the impulse that originated the researches and the impetus that kept them going were not products of the writers' cerebration. It should be our business to help the young scientist one step farther by encouraging him to undertake a little piece of work on his own initiative and to carry it through by his own effort. The academy will serve a good purpose if it emphasizes the value of such work by urging the young man or woman to contribute to the program at a general meeting where results of the study may be discussed. If his offering meets with a sympathetic reception and his paper appears in print his self-respect will be increased and his standing in the community will be raised and as a natural reaction his mental processes will become vigorous and he will, in consequence, become a more and more valuable teacher of his science and a far better leader of his students. In order to accomplish this end, I believe it is necessary to assign a large part of the program at the annual meeting to the young scientists. The older ones have their national technical societies in which to make their flights, but the younger ones, who are not in large cities, have no place in which to try their wings unless it is furnished them by the state academies.

But experience teaches that the normal young man or woman will not willingly appear on a program if he feels that most of the papers are to be by seasoned investigators, because of the fear that his contribution will seem too trivial by contrast. Consequently, I repeat, the program must be left largely to the beginners in research. It may be desirable to flavor the program with a few papers by the older men, but it should be distinctly understood that the success of the meeting is mainly in the hands of the younger men. I have confidence that if the young scientists of the state are convinced that the academy meetings are for them, they will accept the responsibility for making them of value and will work earnestly to that end. I believe the most important function of the state academy is to encourage the young science teacher and that if it can do this successfully it will warrant the work and the effort expended in keeping it alive.

This year the Illinois Academy is experimenting to learn whether the views that have been expressed are justified or not. Not only are the young instructors of the preparatory schools

and colleges being urged to share largely in the coming meeting, but also the senior students in the colleges. The sectional meetings have been placed under the control of the younger instructors in universities, colleges and high schools and they have been asked to secure as many papers as possible from persons who have never before been on the program. As the result of a vigorous campaign there have already been submitted to the committee on the program the titles of ninety-one papers, of which only twenty-one are offered by university instructors of the higher grades. Men representing state departments of science have offered fourteen papers, college instructors and associates and assistants in the universities twenty-six papers and students and unattached scientists thirteen. The remaining seventeen papers are in the sections devoted to public health, psychology and education in which the contributions must naturally be highly technical.

But we are trying this year to do even more than simply interest young men and women in continuing their scientific training. We are attempting also to encourage the boys and girls of the high schools to employ proper methods in scientific work. We are not yet sure how this may best be done but we are making a start at solving the problem. Our first step was to affiliate with the academy the science clubs already organized in the high schools. Our next step will be to try to organize clubs in those schools in which now no such clubs exist. We are organizing a special section which will be devoted to subjects that appeal to boys and girls of high school age and at the coming meeting in May they will have a section controlled by themselves. The students of Knox and Lombard Colleges and of the high school at Galesburg will act as hosts and the subjects for discussion will be radio, taxidermy, bird study and home chemistry.

The coming annual meeting will not be of the same high technical value as last year's meeting at Rockford, but a much larger number of persons will participate in it—and a much larger share of the papers will be presented by young persons. Most of the articles will be short, but many of them will represent the first attempts at individual work on the part of their authors. The general meetings have been arranged mainly for educational effects. The morning program will comprise three talks on evolution in which the reasons for the acceptance of the doctrine as a working hypothesis will be given in a popular way by a botanist, a zoologist and a paleontologist. The evening program will be a little more technical but it also will be educational in purpose. The morning meeting will be mainly for the public in general and the evening meeting for the academy members and that portion of the public that is scientifically inclined.

It is hoped that the general and scientific meetings between them will accomplish the three functions that seem most natural to a local scientific organization without duplicating any of the activities of the national societies.

W. S. BAYLEY

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE SAFEGUARDING OF NATIONAL PARKS[1]

WHEREAS, by repeated action by Congress for more than half a century, widely approved by scientific and other societies and by the public generally, the National Parks of the United States have been completely conserved from industrial uses so as to constitute a system of National Museums of Native America, and

WHEREAS, one of the national parks of Canada is similarly completely conserved, and

WHEREAS, the combined National Parks System of both countries, covering geological, biological and geographical examples from the Alaskan Range, through the Canadian Rockies, to the Grand Canyon of Arizona, if preserved untouched, will constitute a unique Continental Exposition of inestimable value to science and to the popular education of future generations; and

[1] A resolution favoring the complete safeguarding in perpetuity of all national parks in the United States and Canada against every economic or commercial use of whatever kind, adopted in principle by the executive committee of the council of the American Association for the Advancement of Science at the regular fall meeting of the committee, October 21, 1922, and issued from the Washington office of the association, April 25, 1923.

WHEREAS, at the option of a single official of the government, several of the national parks in the United States are nevertheless open to mining and grazing, while the control of water power in future parks has recently been surrendered to the Water Power Commission; and all but one of the national parks in Canada are similarly open to certain economic or commercial uses; and

WHEREAS, this generation can pass on to future generations no greater gift than these parks in their primitive condition. Therefore,

BE IT RESOLVED, That the American Association for the Advancement of Science earnestly requests the people and the Congress of the United States and the people and Parliament of the Dominion of Canada to secure such amendments of existing law and the enactment of such new laws as will give to all units in the international parks system complete conservation alike, and will safeguard them against every industrial use either under private or public control at least until careful study shall justify the elimination of any part from park classification.

THE STATUS OF PUEBLO INDIAN LANDS[1]

WHEREAS, the economic status of the Pueblo Indians in New Mexico is in jeopardy because of various land and irrigation claims of non-Indians; and,

WHEREAS, the United States has justly guaranteed to the Pueblo communities the titles of their lands and the irrigation and other rights pertaining thereto; and,

WHEREAS, every interference with their natural condition will destroy the usefulness of these areas to science and education; and

WHEREAS, the Congress of the United States has recently been considering the passage of laws to quiet land-title disputes between non-Indians and the Pueblos; therefore, be it

RESOLVED, That the American Association for the Advancement of Science, an organization of over 11,000 American scientists and friends of science and education, unequivocally favors the full and complete protection of the Pueblos in all their fundamental land, irrigation and cultural rights, to the end that they may continue to live their own lives in as nearly their own manner as is possible and with as little restriction as is consistent with the rights of their non-Indian neighbors.

[1] Resolution adopted in principle by the council of the American Association for the Advancement of Science at the fourth Boston meeting, adopted in this form by the executive committee of the council of the association at its regular spring meeting held in Washington, April 22, 1923, and issued from the Washington office of the association, April 25, 1923.

SCIENCE AND RELIGION

DR. R. A. MILLIKAN, director of the Norman Bridge Laboratory of the California Institute of Technology, formulated and secured the signatures to the following statement:

A JOINT STATEMENT UPON THE RELATIONS OF SCIENCE AND RELIGION

We, the undersigned, deeply regret that in recent controversies there has been a tendency to present science and religion as irreconcilable and antagonistic domains of thought, for in fact they meet distinct human needs, and in the rounding out of human life they supplement rather than displace or oppose each other.

The purpose of science is to develop, without prejudice or preconception of any kind, a knowledge of the facts, the laws and the processes of nature. The even more important task of religion, on the other hand, is to develop the consciences, the ideals and the aspirations of mankind. Each of these two activities represents a deep and vital function of the soul of man, and both are necessary for the life, the progress and the happiness of the human race.

It is a sublime conception of God which is furnished by science, and one wholly consonant with the highest ideals of religion, when it represents Him as revealing Himself through countless ages in the development of the earth as an abode for man and in the age-long inbreathing of life into its constituent matter, culminating in man with his spiritual nature and all his God-like powers.

RELIGIOUS LEADERS

Bishop William Lawrence, episcopalian, Boston, Massachusetts.

Bishop William Thomas Manning, episcopalian, Bishop's House, Cathedral Heights, New York City.

Dr. Henry Van Dyke, presbyterian, preacher and poet, Princeton, New Jersey.

Dr. James I. Vance, presbyterian, First Presbyterian Church, Nashville, Tennessee.

President Clarence A. Barbour, baptist, Rochester Theological Seminary, Rochester, New York.

President Ernest D. Burton, baptist theologian, president of University of Chicago.

President Henry Churchill King, congregationalist, Oberlin Theological Seminary, Oberlin, Ohio.

Dr. Robert E. Brown, congregationalist, First Congregational Church, Waterbury, Connecticut.

Bishop Francis John McConnell, methodist, Pittsburgh, Pa.

Dr. Peter Ainslie, disciple, Christian Temple, Baltimore, Maryland.

SCIENTISTS

Charles D. Walcott, retiring president of the National Academy of Sciences, president of the American Association for the Advancement of Science and head of the Smithsonian Institution of Washington.

Henry Fairfield Osborn, president of the American Museum of Natural History.

Edwin Grant Conklin, head of the department of zoology, Princeton University.

James Rowland Angell, president of Yale University.

John Merle Coulter, head of the department of botany, University of Chicago.

Michael I. Pupin, head of the department of electromechanics, Columbia University.

William James Mayo, Mayo Foundation for Medical Education and Research, Rochester, Minnesota.

George David Birkhoff, head of the department of mathematics, Harvard University.

Arthur A. Noyes, director of the Gates Chemical Laboratory, California Institute of Technology.

William Wallace Campbell, director of Lick Observatory and president-elect of the University of California.

John J. Carty, vice-president in charge of research, American Telephone and Telegraph Company.

Robert A. Millikan, director of Norman Bridge Laboratory of Physics.

William Henry Welch, director of the School of Hygiene and Public Health, The Johns Hopkins University.

John C. Merriam, president of the Carnegie Institution of Washington.

Gano Dunn, chairman of the National Research Council, Washington, D. C.

MEN OF AFFAIRS

Herbert Hoover, Secretary of Commerce.

James John Davis, Secretary of Labor.

David F. Houston, ex-Secretary of the Treasury.

Frank O. Lowden, Governor of Illinois.

John Sharp Williams, ex-United States Senator, Mississippi.

Rear Admiral William S. Sims, commander United States Naval Forces in European waters during the World War.

Harry Bates Thayer, president, American Telephone and Telegraph Company.

Julius Kruttschnitt, chairman of the executive committee, Southern Pacific Railway.

Frank Vanderlip, ex-president of the National City Bank of New York.

Henry S. Pritchett, president of the Carnegie Corporation of New York.

THE LIFE AND SERVICES OF PROFESSOR JOHN TROWBRIDGE

THE following minute on the life and services of Professor Trowbridge was placed upon the records of the Faculty of Arts and Sciences at the meeting of April 10, 1923:

John Trowbridge was born in Boston on August 5, 1843, the son of John Howe Trowbridge and Adeline Trowbridge. At the age of eighteen, after attending the Boston Latin School, he entered the Lawrence Scientific School by special arrangement, without any previous scientific training whatsoever. In spite of this disadvantage and the further handicap of a serious financial burden, he graduated with the degree of S.B., *summa cum laude*, in 1865. This brilliant success at Harvard doubtless decided the choice of his profession. Decision must have been difficult, since his interest at that time lay fully as much in the direction of art and literature (which remained delightful avocations) as in the direction of science.

From 1866 to 1869 he was a tutor in physics in Harvard College, and during the following year served as assistant professor of physics in the Massachusetts Institute of Technology. He returned in 1870 to Harvard, where he remained, at first (for ten years) as assistant professor, and afterwards as full professor, until the date of his resignation in 1910—a continuous service of forty years. He received the degree of S.D. in 1873, in 1888 was appointed Rumford professor, and on his resignation became Rumford professor *emeritus*. He was a member of the National Academy of Sciences and the American Philosophical Society, and a Fellow of the American Academy of Arts and Sciences, serving as president of the latter body for seven years. He served also as a member of the International Committee on Electrical Units.

On the twentieth of June, 1877, he married Mrs. Gray (the widow of Thomas W. Gray), of Boston, whose young daughter (now Mrs. Edmund M. Parker) helped her to brighten his life. Mrs.

Trowbridge died in 1907 and his own death occurred in his eightieth year, on the eighteenth of February, 1923.

The earlier part of the long period during which Professor Trowbridge was a member of the teaching staff of Harvard College was characterized by the development of laboratory methods in teaching, and by the recognition of research as one of the fundamental activities of the department of physics. Keenly alive to the lack of adequate facilities for the advancement of his chosen field along these lines at Harvard, Trowbridge projected a great physical laboratory and found the means to construct it. When the laboratory was begun, models for such a building were altogether lacking in this country. Nevertheless, so excellent was its design that it still affords adequate facilities for teaching and research; it forms a lasting monument to the genius of the man who planned it.

For thirty years Professor Trowbridge presided as director over the destinies of the Jefferson Laboratory, devoting part of his time to teaching and a larger part to experimental investigation. Problems connected with spectrum analysis and with the conduction of electricity through gases attracted his attention; and his contributions to scientific literature on these subjects were considerable. It was during the progress of these researches that he realized the importance of a constant source of high potential; accordingly he caused the great storage battery to be constructed, which, unique in its time, is still in constant use, and which has proved of the highest value in the study of X-rays.

To the characteristics of foresight and imagination, Trowbridge added the rare gift of stimulating intellectual activity in others. This stimulus was felt by many classes of persons and produced useful results in varied fields. Under his guidance, many men who have won distinction in science took up problems in research for the first time; among them should be mentioned the late Professor B. O. Peirce and the late Professor W. C. Sabine.

Professor Trowbridge's personality was manifested not only in the intellectual activity which he exhibited, inspired and fostered, but also in unselfish and constant devotion to the needs of his students and colleagues. Both traits of his character contributed toward the sentiment of respect and affection with which his memory will ever be cherished by those who came under his influence.

Theodore Lyman
Theodore W. Richards
George W. Pierce
Committee

SCIENTIFIC EVENTS

MEMORIAL TO CHARLES R. VAN HISE

In memory of the late Dr. Charles R. Van Hise, former president of the University of Wisconsin, a large quartzite rock in Ableman will be dedicated as "The Van Hise Rock" on June 3 with appropriate ceremonies and a tablet marker will be placed upon the rock. The rock is of great interest to geologists and it is considered especially fitting that this rock should be dedicated to President Van Hise, because as a geologist he frequently took his students to the rock and used it in explaining geological theories.

Judge E. Ray Stevens, Madison, president of the State Historical Society, will preside at the dedication. Others who will assist in the ceremonies are Professor C. K. Leith, chairman of the university department of geology; John S. Donald, head of the Friends of Our Native Landscape; W. O. Hotchkiss, state geologist; Joseph Schafer, superintendent of the Wisconsin Historical Society; and Dean Harry L. Russell, of the College of Agriculture.

Part of the inscription on the tablet marker is as follows:

> This rock is pictured in geology text-books as a type illustrating important principles of structural geology and has been a point of special interest to many investigators in geology visiting this region. President Charles R. Van Hise, of the University of Wisconsin, was one of the first and foremost of these.

PROTECTION FOR THE RESULTS OF SCIENTIFIC RESEARCH[1]

French law protects effectively the rights of authors of literary works, musical composers, painters and sculptors, but this is not true of scientists and inventors. The act of 1844, to be sure, provides for the granting of patents on inventions, but in reality only inventions strictly industrial in their nature come within the scope of this law. No pharmaceutic products or remedies of any kind may be patented. This state of affairs has recently given rise to sharp criticism. It has been emphasized that it is unjust that biologic discoveries and inventions which are of the greatest practical value in agriculture, in veterinary science and in human

[1] *The Journal of the American Medical Association.*

medicine, and which occupy to-day such an important place in pure and applied science, should be deliberately excluded from the benefits of the law respecting letters patent and should become public property from the date of their origin. The question was made the subject of a long discussion at a meeting of the Confederation of Intellectual Workers and the draft of a law providing for the protection of the rights of scientists has been prepared by a commission. According to this draft, the text of which has been submitted to the chamber of deputies and the League of Nations, the authors of scientific discoveries and inventions shall enjoy, for the duration of their life, the exclusive right of deriving a profit from their invention or discovery. Entitled to protection under this proposed law are: discoveries (that is, demonstrations of the existence of previously unknown principles, bodies, agents or properties of living beings or matter), inventions (that is, creations of the mind consisting of methods, apparatus, products, compositions of products as yet unknown) and, in a general way, all new applications of discoveries and inventions. To establish his right, the author of the discovery or invention must prove that his discovery or invention has been given sufficiently wide publicity. Publication in certain accepted periodicals will be regarded as sufficient publicity. Reproduction for commercial purposes of the name of the author of the published text or of the scientific communication and the bibliographic reference is prohibited, unless the written consent of the author is secured. The authors of inventions and discoveries may not oppose the industrial or commercial exploitation of new applications of their discoveries or inventions, but they will retain an author's rights in any exploitation in which applications of their initial inventions and discoveries have been made. The authors of discoveries or inventions in the domain of therapeutics will participate in the benefits of this law, it being understood that they can not exploit of themselves their discoveries and inventions unless they hold the diploma of a pharmacist.

THE TREND OF FORESTRY IN IDAHO

AT an open meeting of the Idaho Chapter of Sigma Xi, recently held at the University of Idaho, Moscow, "The trend of forestry in Idaho" was presented by Dean F. G. Miller, Professor C. Edward Behre and Dr. Henry Schmitz of the forest faculty. Dean Miller discussed the economic phases of the forestry situation particularly in north Idaho, where is found the largest body of white pine extant. He pointed out that about 48 per cent. of the timber in this part of the state was owned privately while the government held forty per cent. and the state about twelve per cent. He further showed that the greater bulk of the privately owned timber would in all probability be exhausted in the next twenty-five to thirty years. Since the government and the state can not supply on a sustained yield basis more than a fraction of the present annual cut, a serious slump in the lumber industry is inevitable.

Professor C. Edward Behre presented a series of lantern slides showing conditions in the Western White Pine and Western Yellow Pine stands of Idaho during and after logging operations, illustrating how these forests could be kept continuously productive if cut under national forest regulations and protected from the ravages of fire. The slides presented demonstrated the futility of the broadcast burning of logging slash as a permanent protective measure in the white pine forests and showed the tremendous waste in destruction of advance young growth which broadcast burning caused in both the white and yellow pine types. The need for research in forestry was emphasized by pointing out the various problems arising in providing for future forest growth.

Dr. Henry Schmitz spoke on the "Trend of research in forest products." The point was emphasized that the United States is annually consuming over four times as much timber as is produced by the forest areas and that this state of affairs can not go on indefinitely. The problem can partly be solved by increasing the yield of the various products made from wood. The place of research in this connection was discussed at some length particularly as applying to wood preservation, wood distillation, the manufacture of paper pulp and kiln drying.

SYMPOSIUM ON COLLOID CHEMISTRY AT THE UNIVERSITY OF WISCONSIN

THE University of Wisconsin announces a public symposium on Colloid Chemistry, to be held at Madison from June 12 to 15, 1923, in-

clusive. All interested are cordially invited to attend and to participate in the discussions.

Room reservations will be made for those guests who send notification of their expectation to attend. Such reservation is desirable as the hotel facilities in the city are somewhat limited. Such notification should be sent at once to Professor J. H. Mathews, Department of Chemistry, University of Wisconsin.

Attention is called to the fact that Professor Svedberg will give a series of about twenty-four lectures on colloid chemistry during the summer session of the university (June 25 to August 4). The program of the lectures is as follows:

The colloidal state in metals and alloys: J. Alexander.

Precipitation of sols by alcohol: W. D. Bancroft.

Membrane potentials and their relation to anomalous osmose: F. E. Bartell.

Conditions affecting the hydrolysis of collagen to gelatin: R. H. Bogue.

Thermochemistry of sulfur sols: F. L. Browne.

General considerations of the forces determining the limiting size of the colloidal particle in any given solution: E. F. Burton.

On the theory of the lyophilic colloids: Martin Fischer.

The application of colloid chemistry to agricultural problems: R. A. Gortner.

Gel formation: H. N. Holmes.

On the precipitation of colloidal metals by means of metals in the solid state: L. Kahlenberg.

The colloid chemical problems in the manufacture of enzymic and animal glandular products: D. Klein.

The thermochemistry of protein behavior: J. H. Mathews and B. W. Rowland.

Dispersity of silver halides in relation to their photographic behavior: S. E. Sheppard.

Colloidal properties of rubber and compound ingredients: E. B. Spear.

Demonstrations of colloid chemistry technique: The. Svedberg.

The problems of adsorption from the standpoint of catalysis: H. S. Taylor.

The formation of inorganic jellies: H. B. Weiser.

The swelling of protein jellies: John A. Wilson.

Surface films as plastic solids: Robert E. Wilson.

MEDICAL FELLOWSHIPS OF THE NATIONAL RESEARCH COUNCIL

These fellowships are supported by joint contributions of The Rockefeller Foundation and the General Education Board and are administered by a special medical fellowship board of the National Research Council.

The fellowships are open to citizens of both sexes of the United States and Canada who possess an M. D. or a Ph. D. degree, or the equivalent of one of these degrees. They are intended for recent graduates and not for those already professionally established.

The basic stipends awarded are $1,800 for unmarried and $2,300 for married fellows per annum. These stipends may be increased when there are other dependents or for other cogent reasons. Awards are made for one year, but fellowships may be renewed. Fellows are chosen at semi-annual meetings of the medical fellowship board in April and September and applications to receive consideration at these meetings must be filed on or before March 1 and August 1, respectively. Appointments may date from any period subsequent to the board meetings.

The fellowships are designed to recruit men and women as medical teachers and investigators. Fellows may choose any branch of medicine or public health for their ultimate career, but at present those candidates (otherwise suitable) will be favored who plan to specialize in one of the preclinical sciences or to approach clinical medicine through temporary identification with one of the sciences.

The fellowships are not granted to any institution or university, but the choice of place to work, either in this country or abroad, is left to the fellow, subject to the approval of the fellowship board. The appointments are for full time and no other remunerative or routine work is permitted.

The particular individual with whom a fellow wishes to work should ordinarily have agreed to accept him prior to the consideration of his application by the board.

Opportunities, but not obligations, for a certain amount of teaching must be available. It is further required that the fellow be charged no fees or tuition by the institution where he chooses to work.

Further particulars concerning these fellowships may be obtained by addressing the Chairman, Board of Medical Fellowships, National Research Council, 1701 Massachusetts Avenue, Washington, D. C.

SCIENTIFIC NOTES AND NEWS

THE men's dormitory that is being built by the board of athletic control of Stanford University out of income from the stadium as a gift to the university will be given the name Branner Hall, to commemorate the services to Stanford University and the sympathetic interest in student affairs of the late John Casper Branner, pioneer member of the faculty, first head of the geology department and second president of the university.

AT a recent meeting of the board of curators of the University of Missouri, the name of the biology building which houses the departments of zoology and botany was changed to Lefevre Hall in honor of the late Professor George Lefevre's labors for the university, aside from his porated in the board's action: "Professor Lefevre's labors for the university, aside from his connection with this building, merit such a memorial. But there is further justification for thus honoring his memory; the biology building is his creation more than that of any other man. During its construction the architects, the administrative officers of the university and his associates in the department of zoology alike acknowledged a leadership culminating in a laboratory that continually excites admiration for its beauty, its convenience and its effectiveness in meeting the needs of the departments of botany and zoology."

THE funeral of the late Arthur Gordon Webster at the chapel of the Massachusetts Crematory Society was attended by Dr. Charles W. Eliot, president emeritus of Harvard University, and nearly a hundred professors from Harvard University, the Institute of Technology and Clark University. The pall bearers were Dr. G. Stanley Hall, president emeritus of Clark University; Dr. Ira N. Hollis, president of Worcester Polytechnic Institute; Dr. William E. Story, former professor of mathematics at Clark and Harry Worcester Smith, all of Worcester; Dr. Michael I. Pupin, of Columbia University; Dr. Philip Kilroy, of Springfield; President S. W. Stratton, of the Massachusetts Institute of Technology, and Professors Edwin H. Hall, Charles R. Lanman and George F. Moore, of Harvard University.

DR. FRANK J. MONAGHAN has been appointed commissioner of health for New York City, succeeding Dr. Royal S. Copeland, elected to the United States Senate. Dr. Monaghan has been sanitary superintendent of the city for the past five years.

DR. OLIVER BOWLES, mineral technologist of the Bureau of Mines, has been designated by the secretary of the interior as superintendent of the new mining experiment station of the bureau to be established at Rutgers College, New Brunswick, New Jersey, which will specialize in problems involved in the production and utilization of the various non-metallic minerals. Dr. Bowles will enter upon his new work on July 1.

DR. GEORGE W. HOOVER, for the past nine years chief of the Chicago district of the U. S. Department of Agriculture, has been appointed chemist in charge of the drug control of the United States.

AT a banquet of the Chicago Section of the American Chemical Society on May 25, the Willard Gibbs Medal was presented to Professor Julius Stieglitz, of the University of Chicago, in recognition of his research work on molecular rearrangement and his interpretation of univalent nitrogen. The medal was presented by its founder, Mr. W. A. Converse.

IN commemoration of his eightieth birthday, a dinner was given on May 3, to Dr. Henry M. Hurd, professor of psychiatry in the Johns Hopkins Medical School.

A BANQUET was given on May 28 in honor of Professor Filibert Roth, for twenty years a member of the forestry department of the University of Michigan, by the foresters of the state. Among the speakers were Dean F. F. Moon, of the New York State College of Forestry; Professor Ralph S. Hosmer, of Cornell University, and President Marion L. Burton.

A PRIZE medal has been endowed in honor of Professor Hans Horst Meyer, of Vienna. It is

to be awarded every five years for distinguished work in the domain of theoretical medicine. It was presented for the first time to Professor Meyer himself on the occasion of his recent sixtieth birthday.

Dr. Henry Kraemer, Mount Clemens, Michigan, has been elected an honorary member of The Pharmaceutical Society of Great Britain.

At the spring meeting of the Association of Virginia Biologists, held at the College of William and Mary on April 27, the Virginia Academy of Science was organized. Dr. I. F. Lewis, of the University of Virginia, was elected president and Dr. E. C. L. Miller, of the Medical College of Virginia, secretary-treasurer. In response to an announcement of the proposed organization sent out before the meeting, more than one hundred and fifty have signified their intention of becoming members of the new academy. The next meeting of the academy will be held at Washington and Lee University, Lexington, Virginia, during the first week in May, 1924.

Harris J. Ryan, professor of electrical engineering at Stanford University, California, was elected president of the American Institute of Electrical Engineers at the annual business meeting on May 18. Vice-presidents elected were: H. E. Bussey, Atlanta; S. E. M. Henderson, Toronto; William F. James, Philadelphia; J. E. Macdonald, Los Angeles; Herbert S. Sands, Denver. The annual report of the board of directors presented at the meeting showed a net increase in the membership during the year of 1,035, the total membership on April 30 being 15,298.

Dr. Payson Clark, of Boston, was elected president of the American Laryngological Association at their forty-fifth convention held at Boston on May 19.

Professor George H. Shepard, member of the American Society of Mining Engineers and professor of industrial engineering and management at Purdue University, has been appointed to succeed Frank B. Gilbreth as chairman of the committee on fatigue elimination of the Society of Industrial Engineers.

Dr. A. E. Jenks, professor of anthropology and director of the Americanization Training Course of the University of Minnesota, has been appointed chairman of the division of anthropology and psychology of the National Research Council for the year 1923-24. Dr. and Mrs. Jenks will move to Washington on September 1. During the summer Professor Jenks will give two courses of lectures in the department of education in the summer session of the University of California (Southern Division) in Los Angeles.

Professor W. A. Noyes, head of the department of chemistry at the University of Illinois, has been granted a year's leave of absence which he is planning to spend in Europe. Professor Noyes is a delegate of the National Research Council to the International Union of Pure and Applied Chemistry, meeting in Cambridge from June 17 to 24, and a delegate of the American Association for the Advancement of Science to the British Association meeting in Liverpool in September. He will also attend a conference of the Faraday Society on the subject of atomic structure which will be held in Cambridge in July.

Members of the Williams Galapagos Expedition, including Dr. William Morton Wheeler, of the Bussey Institution of Harvard University, and Dr. William Beebe, leader of the expedition, arrived in New York on the steam yacht *Nona* last week, after a ten-week cruise among the Galapagos Islands, off the coast of Ecuador.

Dr. A. B. Stout, of the New York Botanical Garden, who has been in residence at Pomona College during the year, has been making a study of the citrus industry and also of the date and avocado culture. Dr. Stout has been asked by the United States Department of Agriculture to return to Southern California next year to continue this special research work under government direction.

Charles W. Gilmore, paleontologist, of the United States National Museum, has left Washington to superintend the unearthing of the fossil remains of a dinosaur discovered near Jensen, Utah.

Dr. W. A. Osborne, professor of physiology at the University of Melbourne, has returned to Melbourne after a study leave of absence in America and Great Britain.

WILFRED G. PARKINSON, of the Carnegie Institution of Washington, sailed on May 3 enroute to Huancayo, Peru, to make observations at the observatory of the department of terrestrial magnetism.

PROFESSOR MARCUS E. JONES, of the University of Utah, whose botanical collection has recently been acquired by Pomona College through the generosity of Miss Ellen Scripps, of La Jolla, has arrived in Claremont. He will make this his residence and will cooperate with Dr. Philip A. Munz in the arrangement of the herbarium.

DR. EDGAR F. SMITH will give the commencement address at the University of Kansas. He will also address the Arkansas section of the American Chemical Society on July 12.

ON May 11, Professor F. R. Moulton, of the University of Chicago, was the guest of the mathematics department and the Sigma Xi and the Pi Mu Epsilon honorary fraternities of the Ohio State University. After the dinner, he gave a public address on "Some rambles in space and time."

DR. CARL L. ALSBERG, director of the Food Research Institute, Stanford University, San Francisco, delivered a lecture on "Economic aspects of our food supply" before the School of Hygiene and Public Health of the Johns Hopkins University on April 16.

DR. JAMES E. ACKERT, of the Kansas State Agricultural College, delivered the annual Phi Kappa Phi address at the Oklahoma Agricultural and Mechanical College on May 22. The subject of his address was "The relation of the hookworm to medical and agricultural education."

PROFESSOR CHARLES T. KNIPP, of the department of physics of the University of Illinois, addressed on May 18 the annual meeting of the Indiana Physics Teachers' Club, held under the auspices of Rose Polytechnic Institute and the Indiana State Normal School, on "The historical development of the three electrode vacuum tube."

A SPECIAL meeting of the Linnean Society of London was held on May 10, when Professor Paul Kammerer, of Vienna, lectured on his experiments concerning "The inheritance of acquired characters."

THE Croonian lectures before the Royal College of Physicians of London will be given by Professor J. B. Leathes, F.R.S., on the subject of the part played by fats in vital phenomena. There will be four lectures, which will begin on June 7.

DR. HANS GOLDSCHMIDT, German chemist and inventor of the thermit process of welding iron and steel, died in Baden-Baden, Germany, on May 20.

THE trustees of the National Geographic Society have authorized a tablet at Camp Clay, Cape Sabine, in the Arctic, in memory of the eighteen men of the Greely expedition who died there in 1884. Major General A. W. Greely, retired, dean of living Arctic explorers and leader of the party, now lives in Washington. The tablet is one of a series the Geographic Society will place as memorials to Americans who have made history in Polar explorations. Memorials to Rear Admiral Peary, discoverer of the North Pole, and to Rear Admiral Charles Wilkes, discoverer of the Antarctic continent, have already been erected in Arlington National Cemetery, Washington. The tablet to the Greely party will be carried by Donald B. MacMillan when he starts north in June for further explorations of the Arctic and it will be placed in position by him on the rock cliff facing the camp.

DURING the exposition to illustrate the advances in science due to Pasteur's discoveries, which will follow the unveiling of the Pasteur monument at Strasbourg on June 1, medical and scientific congresses will be held as follows: June 1, Hygiene and bacteriology; June 2, Tuberculosis; June 11, Ophthalmology; July 23, Cancer; July 24, Dermatology and syphilology, and July 26, Leprosy.

THE Congress of Intellectual Workers, which was to have taken place at Berne on July 6 and 7, has been postponed.

THE sixth congress of the International Surgical Association will be held in London from July 17 to 20, under the chairmanship of Sir William Macewen.

THE Clinical Surgical Society of America will hold its thirty-sixth annual meeting at Washington University School of Medicine on

May 28 and at the clinic of Dr. Willard Bartlett at the Missouri Baptist Sanitarium May 29. Papers by local surgeons will be delivered on recent advances on thoracic and cardiac surgery, X-ray therapy and kindred subjects.

UNIVERSITY AND EDUCATIONAL NOTES

HALF a million dollars has been appropriated by the New York State legislature to start work on a new plant industries building for the College of Agriculture at Ithaca. A few years ago the state adopted a program that called for the expenditure of $3,000,000 and the college has been empowered to proceed in a building plan in accordance with this appropriation, though it may not expend more than the amount made available in any one year.

THE residue of the estate of the late George E. Hoadley, of Trinity College, is to be divided equally between Trinity College and the Connecticut Historical Society. Each institution will receive about $200,000.

PROFESSOR W. A. HAMILTON has been appointed chairman of the administrative interim committee of Beloit College, until a president of the college is appointed to succeed President M. A. Brannon, who was recently made chancellor of the University of Montana. Professor H. H. Conwell has been appointed acting head of the department of mathematics.

DR. DAVID FRIDAY, president of the Michigan Agricultural College, has presented his resignation to become effective on June 1. The State Board of Agriculture accepted the resignation over the protest of Governor Groesbeck. Dr. Friday has accepted a professorship of economics at the new school for Social Research in New York City.

DR. BRADLEY STOUGHTON, formerly of Columbia University and later secretary of the American Institute of Mining and Metallurgical Engineers, a New York consulting engineer, has been appointed professor of metallurgy at Lehigh University.

DR. HARRY A. CURTIS, government nitrate expert, has accepted an appointment as professor of chemical engineering at Yale University.

AT the University of Chicago, Dr. Andrew C. Ivy, of Loyola University, has been appointed associate professor of physiology and Ernest P. Lane, of the University of Wisconsin, assistant professor of mathematics.

DISCUSSION AND CORRESPONDENCE

DYE SOLUBILITY IN RELATION TO STAINING SOLUTIONS

IN a recent note appearing in these pages[1] attention was called to the fact that different batches of stain may contain very different amounts of actual dye; hence, staining solutions made up according to formulae calling for so many grams of dry stain may vary considerably in their actual strength. For this reason it was recommended in the note above mentioned that solutions of stain be made up by using definite quantities of saturated solution of the stain. In this way it was believed that the resulting solutions would be much more nearly the same strength than when prepared on the basis of weight of the dry stain.

There seems to be no question but that this statement is correct as far as it goes; but since the publication of the above mentioned article a certain serious criticism of the procedure recommended has been brought to our attention. It seems that the solubility of a dye varies considerably according to the amount and kind of mineral matter present in solution. It is well known in the dye industry that many of the dyes may be "salted out" of solution, that is precipitated by the addition of some mineral salt. Now the inert material present in many samples of stain is of a mineral nature and may act in the same way. There is never enough present to prevent the dye itself from going into solution, but there is often enough to lessen its solubility. For this reason two staining solutions made up from a pure and an impure dye, respectively, each containing ten per cent. of a saturated alcoholic solution may vary considerably in their actual dye content. This is not only theoretically true, but practical experience in the handling of stains has shown that it may actually be the case.

On account of this fact it is very plain that

[1] The preparation of staining solutions, SCIENCE, 67, January 5, 1923, p. 24.

preparing a stain on the basis of saturated alcoholic solution is not an ideal procedure. At the present time it is perhaps the best method possible, since many different brands of stain are available which vary greatly in their total dye strength without any indication to the purchaser as to what their actual dye content may be. Solutions made up as recommended in the previous article will certainly be more nearly constant than those prepared on the basis of dry weight under such circumstances as these; but the procedure is far from satisfactory.

The ideal to be hoped for is this: That every manufacturer of stains print on his label the actual dye content and the moisture content of the particular batch of stain on which the label is placed; and that every one publishing stain formulae prepare them on the basis of weight of *pure dye*. Such staining formulae will be very different from the ones found in the literature at present, because most of the latter were prepared on the basis of stains that were seldom more than fifty per cent. actual dye strength. Of course, it is too much to expect such a revolution in the preparation of staining formulae immediately; but the first step has already been taken in that one of the stain companies has promised to place on every label the information concerning dye strength and moisture content which is necessary. Any one writing a text book or article in which stain formulae will be given is urged to pay attention to this fact and so far as possible to cooperate with the commission in publishing stain formulae in standardized form. The commission will be very glad to cooperate with any one who wishes to adopt this new form of stain formulae and will furnish any necessary information which is available.

COMMISSION ON THE STANDARDIZATION OF BIOLOGICAL STAINS.

H. J. CONN
Chairman

"THE NEW AIR WORLD"

IN SCIENCE of March 30, Dr. William J. Humphreys, under the caption "Three of a Kind," criticizes my recent book, "The New Air World." His criticisms are so lacking in accuracy that I assume you will allow me space in which to answer some of them. It is a fact that I shall be glad to verify with documentary evidence for your inspeciton that this book has been highly commended by many scientists of high standing and that to my knowledge there is not an unfavorable criticism of it except by Humphreys and Alexander McAdie.

In 1910, through the Appleton Press, I published a college text-book called "Descriptive Meteorology." In the preface of this book it is clearly stated that I "consulted with and received valuable aid from Professor W. J. Humphreys on many technical points in the physics of the book," and it is a fact familiar to many officials of the Weather Bureau that Humphreys read every galley proof and every page proof of that book and that I made changes in my original copy as the result of his suggestions and that this book had his approval, as it was intended for the teaching of the observers and others of the bureau with whom he was expected to be in close association in the future. Now any one in comparing this book with the one that Professor Humphreys now so severely criticizes and which he says "contains scores of errors and numerous loose and inaccurate statements" will see that the second book is simply the first book stated in popular language for the lay reader and for pupils of the grammar schools, with the addition of a few entirely new chapters, and these new chapters he has not specifically attacked. Much of what he approved then he disputes now.

First, he objects to the book because it contains material "merely of the grammar-school grade," when in point of fact the author did not intend it for anything more, saying in his introduction: "an effort (is) made to tell a simple story that will awaken curiosity and lead the reader to wish to know more and more of the mysteries of the atmosphere."

Second: he quotes from page 8 of my book the statement that "The atmosphere is thus by the absorption of radiation warmed largely from the bottom upwards, which accounts for the perpetual freezing temperatures of high mountain peaks, although they are nearer the sun than are the bases from which they rise."

Then he says: "This, as any physicist knows, is a wholly inadequate explanation of the phenomenon in question." But he withholds from

the reader the fact that page 8, from which he extracted only five lines, contains what I believe a competent person would regard as a "wholly adequate explanation." It is as follows:

> Oxygen and nitrogen, which form the greater part of the atmospheric gases, absorb comparatively little of the solar rays, while water-vapor, which constitutes a little more than one per cent. of the atmosphere and which remains close to the earth, absorbs large quantities. From the fact that one half of the atmosphere, including nearly all of its water-vapor, lies below an elevation of three and one half miles, it becomes evident that the greater part of the absorption of the sun's rays must take place in the lower strata. On clear days the atmosphere absorbs nearly one half of the sun's rays; the remainder reaches the surface of the earth, warms it and in turn is radiated back into the air—with this difference: that as earth radiation the wave motion of the rays is longer and slower than it was when the rays entered our atmosphere as solar radiation. In this slower form the rays are more readily absorbed. The atmosphere is thus warmed largely from the bottom upwards, which accounts for the perpetual freezing temperatures of high mountain peaks, although they are nearer the sun than are the bases from which they rise.

Now read the explanation that Humphreys gives of this phenomenon in his criticisms published in SCIENCE on March 30 last, and judge as to which is the more lucid and "adequate":

> Absorption at the surface in excess, on the average, of radiation; and radiation of each portion of the upper air, up to eleven kilometers, roughly, above sea level, in excess, on the average, of absorption, are the necessary and sufficient causes, through the convection thus maintained, of the practically continuous state of decrease of temperature, in this lower portion of the atmosphere, with increase of height.

Talk about "loose and inaccurate" statements! I submit this as a sample of incoherency well knitted together; and it is about as "inaccurate" as anything well could be, for no one ever before heard of "convection" being "thus maintained." I must further embarrass Professor Humphreys by stating that the explanation given by me in "The New Air World" and which he criticizes may be found substantially in substance on page 82 of "Descriptive Meteorology" hereinbefore mentioned, which he carefully read and approved before it was published and he never has repudiated the credit given him in the preface of that work.

Third: he disputes my statement about the hour of maximum temperature reversing from day to night at the altitude of about one and one half miles and says that if I "had first studied the records" I would have found that "the lowest temperature at level *is* at night, or more exactly at 5 to 6 A. M., substantially as at the surface."

Here again the cold records will embarrass Professor Humphreys, but I will have to leave him to contend with Dr. William R. Blair and Professor Charles F. Marvin, chief of the Weather Bureau, with whom he comes squarely into conflict. As chairman of the sub-committee on the relations of the atmosphere to aeronautics, submitted to the National Advisory Committee during the World War, Professor Marvin approved report No. 13, written by Dr. Blair. On page 46 of this report it is stated: "The afternoon maximum temperature disappears between the 1.5 and 2 kilometers levels in the summer months and between 1 and 1.5 kilometers levels in the winter months," and pages 47 and 48 diagrammatically present the information and show Humphreys in error.

I have answered specifically but three of Professor Humphreys' criticisms, but I think these answers are sufficiently "adequate" to show the nature of all of them.

WILLIS L. MOORE

With your kind permission I shall reply briefly to the above rejoinder.

So far as I know (and I have inquired at the library of the Weather Bureau) none of the eminent scientists who "highly commend" "The New Air World" has published his commendation in a reputable scientific journal.

If any one is sufficiently interested and knows meteorology I can show him more than one hundred errors and loose statements in this book.

As to my responsibility for the statements that appear in "Descriptive Meteorology," allow me to say that Professor Moore is entirely too lenient. I read not only the proof of this book but also the original manuscript in its different stages and removed an amazing number of errors. I also wrote chapter VIII and

portions of some others; nor was I alone in making such requested contributions. Finally, the late Cleveland Abbe put much labor on the proof. In short, everything practicable was done, with the material in hand, to save the bureau's face. Nevertheless, a number of errors still remain in this book, including the insufficient explanation of the cold of mountain peaks.

The longer quotation from "The New Air World" does not help matters and would not even if so rewritten as to be precise. From the fact that the lower atmosphere is a better absorber, in general, of solar and terrestrial radiations than is the upper, one might *jump* to the conclusion that therefore the temperature of the air must rapidly decrease with increase of elevation. But, then, the lower atmosphere is, in general, a much better radiator than is the upper air, and so one might with equal reason *suppose* that the temperature of the air must rapidly increase with increase of elevation. If confronted with the fact that the lower atmosphere is both a better absorber and a better radiator than is the upper he might *guess* that there would be but little change of temperature with change of elevation. In each of these cases the argument is inconclusive. The complete explanation, though it could be elaborated into a chapter, is outlined in the sentence which Professor Moore says he is unable to follow—a summation appropriate to a scientific journal and entirely clear, as I know from actual tests, to those who understand the phenomenon under discussion.

As to the time of day at which the minimum temperature occurs, on the average, at an altitude (author does not state whether above surface or sea-level) of one and a half miles, let me say that Dines, in his paper "The characteristics of the free atmosphere," Meteorological Office, London, 1919, reviews all the contributions, about half a dozen, that up to that time had been published on the daily temperature range in the free air and concludes that this range decreases rapidly with height and that above two kilometers the range is so small that it is uncertain when either the maximum or minimum occurs. Beginning with 1916, however, the Weather Bureau has collected a large amount of information on this subject which shows that at a mile and a half above the surface at the station (Drexel) where this information was obtained the diurnal temperature range is small and that the minimum and maximum temperatures, respectively, occur, on the average (seasonal and annual), at about the same times at this level as at the surface, as perhaps one would expect to be the case, except at the times and places of strong vertical convection.

Professor Moore's excuses for the above two errors do not, as he implies, prove that he was right in saying that at the altitude of 100 miles the temperature is absolute zero; that there could be no atmosphere if the temperature were below —346° F.; that without dust there could be no light; that ozone is highly electrified oxygen, etc., etc.

Finally, let me say that an accurate elementary book merits the highest praise, for it does great good; while a grossly inaccurate one deserves severe condemnation, because of the harm it works through misinformation to children and other unsuspecting victims.

W. J. HUMPHREYS

QUOTATIONS

MR. BRYAN, THE CHURCH AND EVOLUTION

THOUGH Mr. William J. Bryan regards the defeat of his resolution against Darwinism in the Presbyterian General Assembly as a personal humiliation and is said in the press reports to have "sunk into his seat so pale as to appear almost ill" yesterday when the vote against the resolution was declared, it is hard to see how even a conservative believer can be displeased by the resolution on the subject which was adopted by the Assembly. This resolution declares

> that Synods and Presbyteries within whose bounds Presbyterian supported academies, colleges and training schools are located are hereby instructed to exercise careful oversight over the instruction given in such institutions, and that Synods and Presbyteries withhold their official approval from such academies, colleges and training schools where any teaching or instruction is given which seeks to establish a materialistic evolutionary philosophy of life which disregards or attempts to discredit the Christian faith.

The bases of belief would appear to be en-

tirely safe, in Presbyterian or other schools, under such an instruction as that. But Mr. Bryan wished to go further. He proposed to consign a man named Darwin, who never had anything to do with the doctrine or practice of the church, who was a man of science and who merely went through life trying to find out what was true, to ignominy. The resolution which he offered and eloquently advocated declared

that no part of the Educational Fund of the Presbyterian Church of the United States of America shall be paid to any school, college, university or theological seminary that teaches, or permits to be taught as a proven fact, either Darwinism or any other evolutionary hypothesis that links men in blood relationship with any other form of life.

The difference between the two resolutions is significant and fundamental and the decision of the Presbyterian General Assembly is highly important, because by implication it recognizes the fact that perhaps teachers who are as much devoted to the Christian faith as any other may not exclude consideration of the evolutionary philosophy from their teaching; in other words, that an evolutionary philosophy need not by them be regarded as altogether materialistic in its bearings. The Bryan resolution approaches, with a bludgeon merely, a subject which may well engage the attention and summon up the wisdom of the most devout. Manifestly the Presbyterian Church is not prepared to take that attitude.

The Presbyterian Church, in short, avoids the imputation of assuming infallibility. It rests upon the Christian doctrine and proposes to continue to rest upon it, but does not bind the conscience of believers with bands of theological steel. But this is precisely what it would have done if it had adopted the remarkable resolution offered by the Rev. Edward H. Pence of Portland, Oregon, which made this declaration:

That man was evolved with all his mental, moral, spiritual content to his consciousness of self and God by the operation of laws inherently within a form from which he came, and the acknowledgment of possibilities, or even probabilities, that a physical organism may have been evolved by forces and processes implanted by God, sacred, because so chosen and used by Him, and that his organism did not and could not have become human until, by creative fiat of God, he breathed into it the inherent parts which constituted man as the potential son of God.

The defeat of this resolution and Mr. Bryan's, taken together with the temperate declaration which was actually adopted, indicates that the day is past when the right of ecumenical conclusiveness is likely to be assumed by American Protestant bodies.—*The Boston Evening Transcript.*

SCIENTIFIC BOOKS

The Meaning of Relativity. By ALBERT EINSTEIN. (Princeton lectures translated into English by E. P. Adams.) Princeton University Press. 1922.

The present state of the remarkable theory of relativity of Albert Einstein, the degree of maturity which the investigation has reached, the extensive and varied development of the subject which has been set forth in so large a literature, the doubts and difficulties which the theory has encountered, the enthusiasms which it has engendered, the antagonisms which it has aroused, the difficult form which much of the exposition of it has taken, its intimate relations with the deepest realities accessible to investigation—all these render imperative such an exposition of the subject as will make it accessible to a large body of persons interested in the more profound consequences of physical theory. The preliminary announcement of the publication of "The meaning of relativity" by Albert Einstein raised the hope that this book would serve just that purpose.

In a small volume of 123 pages we have here four lectures by Einstein: the first is on "Space and time in pre-relativity physics"; the second is on "the theory of special relativity"; both the third and the fourth bear the title "The general theory of relativity." The lectures open with a brief investigation of the origin of our ideas of space and time and a discussion of the object of science as a means of coordinating our experiences and of bringing them into a logical system. Subjective time is not measurable; we can assign numerical measures to time only by means of some objective phenomena which are recurrent. Simul-

taneity at different places is a notion of which we do not have immediate awareness. We require some convention or agreement before we can say whether distantly separated events are simultaneous or not. In following up this idea one cannot avoid an intimate association of space and time. A realization of this brings him towards one of the fundamental notions of the theory of relativity, namely, that measured space and time are so intimately connected and entangled that we can not deal with either apart from the other. We are forced to think of space and time as indissolubly conjoined into a four-dimensional continuum of space-and-time. This intimate junction of two things previously separated, a junction necessary at least in the measurements of physics, is one of the basic conceptions on which the whole theory of relativity rests. In his first lecture Einstein shows how this comes about and gives something of the mathematical means by which this conjoined space-and-time is to be investigated.

The second lecture is devoted to the milder form of the theory of relativity as Einstein presented it in 1905. This special relativity can be treated without any very complicated mathematical machinery, though even here a full understanding of its detailed development is impossible without considerable mathematics. Einstein here develops the main part of this theory in intimate connection with the various general ideas to which it is related. The exposition is suited to the needs of a serious student of the subject who has already acquired some of the simpler ideas.

Now this special relativity is not comprehensive enough to embrace the phenomena of nature beyond a certain rather narrow range. A more general theory is necessary to bring about agreement with cosmic phenomena. Einstein's construction of this more general theory was set forth in a memoir of 1915. The third and fourth lectures of the present volume are devoted to an exposition of that more general theory. An attempt is made to show the nature of its details and to explain its connections with the famous phenomena of astronomy which have afforded so remarkable a verification of the theory. Full details can not be given in so short an exposition. But the author can and does succeed in making clear the general ideas and in setting before the reader the spirit and trend of the argument and in leading him to see much of the detail of the whole theory. The exposition is thus a very useful one.

A review of such a brief book on relativity should not be ended without indicating the place which it should have with a learner who is working himself into a knowledge of the theory. It is obvious that the book must be authoritative. But it cannot serve as a single volume to lead the reader into a fair introductory knowledge of the whole theory; indeed this was not the purpose of the book. (The reader who desires a single short volume suited to lead him to a fair preliminary conception of the whole subject will find such a book in the second edition of my "Theory of relativity" published by Wiley & Sons, New York.) But the book can be made to serve an important purpose for the learner who wants a fairly rapid and yet comprehensive introduction to the whole theory. He might well begin with Einstein's more elementary book (translated by Lawson, published by Holt & Co. in 1921) entitled "Relativity—the special and general theory." This will lead him readily into the simpler aspects of the theory. This might be followed with the book named at the head of this article. He could then proceed to Weyl's comprehensive "Space—time—matter" (translation by Brose published by Dutton in 1922). Or, he might precede Weyl's book by Eddington's "Space, time and gravitation." By means of these four or five books, all of them available in English, it is possible for one to get a rapid and comprehensive introduction to the whole theory of relativity. They are recommended only to the serious student of the subject. None of the volumes constitutes "light reading."

R. D. CARMICHAEL

TUBEUF'S MONOGRAPH OF THE MISTLETOE

ONE of the most encouraging signs of surviving intellectual life in Mid-Europe is the occasional appearance of masterly publications like the MONOGRAPHIE DER MISTEL (The Oldenbourg Verlag, Munich) by Professor Tubeuf of the University of Munich. For many years

Tubeuf has stood well to the forefront among plant pathologists in the world and his publications on the mistletoe are classic.

The present quarto volume (xii+ 832 pages, 181 text-figures, 35 plates and five distribution maps) will form the starting point for all future studies of this interesting autotrophic plant which nevertheless is parasitic and even divisible into biologic strains in its host selection.

From the day of Theophrastus, the Greek founder of botanical science, the rôle of the mistletoe in saga, folklore and practical horticulture is sketched, and its present-day significance is shown. Special chapters deal with geographic distribution, morphology in its various branches, ecologic relations with other plants and animals, and its many-sided significance as a harmful parasite or an attractive adjunct to a landscape.

Every American University library should possess the book, and no surer indication can be given of America's wish to help the countries of Europe in the heroic struggle of their scholars to hold fast to what they have of culture, than by the prompt purchase of such sterling works as Tubeuf's monograph now that the Mid-European scholar is so hard pressed to keep body and mind and soul together.

WILLIAM TRELEASE.

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SPECIAL ARTICLES

FURTHER NOTES ON THE "WINTER CYCLE" IN THE DOMESTIC FOWL

IN an earlier note[1] we pointed out that the maximum value of the inter-annual correlation between the egg production of the various "cycles" of laying activity in the first and second year in the White Leghorn fowl does not fall on the winter "cycle" as might be expected from current genetic theory, as developed for the Barred Rock breed, but on the autumn "cycle."

We have since shown[2] that the relationship between the first year production of the mother and the first year production of the daughter is $r = 0.128 \pm .033$ while that between the

TABLE 1. DAUGHTER'S FIRST YEAR.

Mother's First Year	Winter	Spring	Summer	Autumn	Annual
Winter	+.1387 ± .0330 4.20	+.0593 ± .0335 1.77	—.0011 ± .0336 0.03	+.0596 ± .0335 1.77	+.0976 ± .0333 2.93
Spring	—.0064 ± .0336 0.19	+.0246 ± .0336 0.73	+.0174 ± .0336 0.51	+.0876 ± .0334 2.62	+.0365 ± .0336 1.08
Summer	—.0084 ± .0336 0.25	+.0074 ± .0336 0.22	+.1173 ± .0332 3.53	+.0429 ± .0336 1.27	+.0564 ± .0335 1.68
Autumn	+.0727 ± .0335 2.17	+.0377 ± .0336 1.12	+.0750 ± .0335 2.23	+.1991 ± .0323 6.16	+.1320 ± .0331 3.98
Annual	+.0959 ± .0333 2.87	+.0536 ± .0336 1.59	+.0721 ± .0335 2.15	+.1380 ± .0330 4.18	+.1279 ± .0331 3.86

TABLE 2. DAUGHTER'S FIRST YEAR.

Mother's Second Year	Winter	Spring	Summer	Autumn	Annual
Winter	+.0578 ± .0335 1.72	+.1057 ± .0333 3.17	+.1025 ± .0333 3.07	+.1630 ± .0327 4.98	+.1440 ± .0329 4.37
Spring	+.0743 ± .0335 2.21	+.1496 ± .0329 4.54	+.1311 ± .0331 3.96	+.0971 ± .0333 2.91	+.1555 ± .0328 4.74
Summer	+.0727 ± .0335 2.17	+.0607 ± .0335 1.81	+.0625 ± .0335 1.86	+.1042 ± .0333 3.12	+.1054 ± .0333 3.16
Autumn	+.1064 ± .0333 3.19	+.0762 ± .0334 2.28	+.1043 ± .0333 3.13	+.2207 ± .0320 6.89	+.1759 ± .0326 5.39
Annual	+.1078 ± .0332 3.24	+.1265 ± .0331 3.82	+.1315 ± .0331 3.97	+.2039 ± .0322 6.33	+.1962 ± .0323 6.07

1 Harris, J. Arthur, and Lewis, H. R., "The 'winter cycle' in the fowl," SCIENCE, N. S., 56: 230-231, 1922.

2 Harris, J. Arthur, and Lewis, H. R., "Biometric considerations on the inheritance of fecundity in the White Leghorn fowl, *Poultry Science* (in press).

second year production of the mother and the first year record of the daughter is $r = 0.196 \pm .032$. While numerically small, these values are both positive and may reasonably be considered statistically significant.

The fact that there seems to be a significant correlation between the annual record of mothers and daughters at once raises the question as to whether the correlation is higher for the period of winter production, with respect to which the birds have heretofore been assumed to be differentiated in genetic constitution, than for the other "cycles."

We are now able to present the thirty-two coefficients measuring the relationship between the four individual "cycles" of the mother's first year and the daughter's first year, table 1, and between the mother's second year and the daughter's first year, table 2.

These coefficients are small throughout, and individually would not be considered significant in comparison with their probable errors. They are, however, preponderantly positive in sign and thus lend support to the conclusion that there is a sensible correlation between the records of mothers and daughters in the type of birds exhibited in contest flocks.

The most interesting feature of this series of results is the fact that the highest correlation is not that between the winter "cycle" of the mother and the winter "cycle" of the daughter, but between the autumn "cycle" of the mother and the autumn "cycle" of the daughter. Thus for the winter "cycle" of the mother's first year and that of the daughter's first year the correlation is $+ .139$ as compared with $+ .199$ for the autumn "cycles." The relationship between the winter "cycles" of the mother's second and the daughter's first year is measured by a coefficient of $r = + .058$ as compared with $r = + .221$ for the autumn "cycles."

This result for inheritance substantiates the conclusions drawn from our earlier studies of inter-annual correlation for the first and second laying year of the same individual.

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THE UTILIZATION OF ATMOSPHERIC NITROGEN BY SACCHAROMYCES CEREVISIAE

A NOTE on some of the results obtained in this laboratory in the course of studies on the nutrition of yeast may be of interest especially in view of the recent communication to this journal by Lipman and Taylor.[1] These authors claim to have proved the utilization of atmospheric nitrogen by the wheat plant. We have been working for a considerable time in this laboratory on the development of the simplest possible medium that will support the continued growth of yeast, and some of the data have a direct bearing on the utilization of atmospheric nitrogen by the organism.

Zikes[2] and DeKruijff[3] claimed that certain Torula can fix nitrogen. Kossowicz[4] stated that certain yeasts could fix nitrogen but later[5] reversed his opinion. Linder and Newman[6] could observe no nitrogen fixation by yeast. Mulvania[7] concludes that some yeasts can use atmospheric nitrogen. His data are qualitative in nature and he made no attempt to dilute out by subculture any nitrogenous compounds originally present in the yeast.

The yeast used in our work was plated out from a Fleischmann yeast cake and is known as *Saccharomyces Cerevisiæ* Race F. The cultures used in the experiments hereinafter described had been subcultured for three years at 30° C. in Medium E developed by Fulmer, Nelson and Sherwood.[8] The medium contained the following per 100 cc.: 10 grams of cane sugar, 0.188 grams of ammonium chloride, 0.100 grams of dipotassium phosphate, 0.100 grams of calcium chloride. The yeast had then been subcultured for six months in Medium C (2) which contained per 100 cc. the following: 10 grams of cane sugar, 0.188 grams of ammonium chloride, 0.100 grams of dipotassium phosphate. Yeast so grown furnished an

1 SCIENCE, lvi, 605 (1922).

2 *Sitzungsber, K. Akad. Wiss (Vienna) Math. Naturw. K.*, 118, 1091, (1909).

3 *Ann. Jard. Bot. Butten. Zorg. Sup.*, 3, Pt. 1, 93, (1910).

4 *Z. Garungsphysiol.*, 1, 253, 5, 26.

5 *Biochem. Zeit.*, 64, 82.

6 *Wehnschr. Proc.*, 30, No. 47, 589, (1913).

7 *Bulletin* 122, Ag. Exp. Station, Univ. of Tennessee.

Chem. Abt., Vol. 15, 2291, (1921).

8 *Journ. Amer. Chem. Soc.*, xliii, 191, (1921).

ash free from calcium or magnesium. While the growth in Medium C was not as rapid as in Medium E the yeast continued vigorous and normal in appearance. The yeast undergoes no deterioration even after two years of growth in this medium.

The yeast so obtained was inoculated into a series of flasks containing per 100 cc. of medium: 10 grams of cane sugar and varying amounts of dipotassium phosphate. In all experiments the temperature maintained was 30° C. There was a distinct optimum at a concentration of 0.45 grams of dipotassium phosphate per 100 cc. This optimum maintained during subculture. The above concentration then was adopted as standard. Conductivity water was used as the solvent. The medium was sterilized under pressure. While still hot, rubber stoppers were inserted, carrying two glass tubes through one of which air was bubbled through the medium, the other tube serving as outlet. The medium was cooled while being aerated with air from which all ammonia and nitrogen oxides had been removed by passing the air through acid and through alkaline potassium permanganate. A sterile medium which had been aerated under the same conditions as the growing culture showed considerably less than one part of ammonia or of nitrites or of nitrates per million parts of medium. The yeast grows nearly as well in this ammonia free medium as it does in Medium C. The cells are normal in appearance and appear to be in an excellent state of nutrition.

These results bring out two points of interest:

(1) The fact that yeast will grow continuously in a medium composed of sugar and one salt. (Pyrex flasks were used which had undergone several hundred sterilizations. We have not as yet made any correction for materials dissolved from the glass.)

(2) *Saccharomyces Cerevisiæ* will grow in an apparently good state of nutrition using atmospheric nitrogen as the sole source of that element.

It may be that the benefits accruing from the aeration of yeast cultures is as much due to the addition of nitrogen as of oxygen.

ELLIS I. FULMER

IOWA STATE COLLEGE,
JANUARY 26, 1923

THE AMERICAN CHEMICAL SOCIETY

(Continued)

PHYSICAL AND ORGANIC CHEMISTRY

SECTION II. COLLOIDS

Standardization in the grading of glue: ROBERT HERMAN BOGUE. So-called standard tests are being developed by the National Association of Glue and Gelatin Manufacturers (*cf.* Alexander, "Glue and gelatin," p. 225). This is to be commended, but the results will necessarily be prejudiced so long as manufacturers only are represented on their committees. A joint committee of manufacturers, consumers and independent experts is obviously necessary for actual and profound progress. Of particular significance is the *arbitrariness* of most or all of the specifications "agreed upon" by the association. Thus, concentration, temperature and procedure are defined by a compromise between extremes in "present practice" instead of by the only sound method—the determination by systematic investigation of the conditions which most accurately evaluate in terms of a fundamental property. Additional data on the use of the MacMichael viscosimeter in the determination of a fundamental property of glues and the conversion of these data to absolute units are given. The use of a pipette type of viscosimeter is discussed and some data bearing on its application and calibration in absolute units are presented.

The action of salts on hydrous cupric oxide: HARRY B. WEISER. Hydrous cupric oxide adsorbs ions strongly. If shaken with solutions of neutral salts, like NaCl or Na_2SO_4, hydrolysis takes place and the solution becomes distinctly alkaline, owing to stronger adsorption of acid than of base. On account of this strong adsorption, the presence of certain salts may accelerate the spontaneous loss of adsorbed water. The hydrous oxide may be heated to 100° without darkening in the presence of very small amounts of salts, such as $MnSO_4$, $CoSO_4$, $Al_2(SO_4)_3$, $Cr_2(SO_4)_3$, $ZnCl_2$ and $CuCl_2$. It has been demonstrated that the absence of darkening is not due to stabilization by adsorption of the hydrous metallic oxides as suggested by Bancroft and reaffirmed by Blucher and Farnau; nor to the formation of basic salts as suggested by Spring and Lucion. The explanation is to be found in the change in physical character from the highly gelatinous to the granular form of the oxide. Only those salts which hydrolyze appreciably giving H-ion are effective in low concentrations, since the slight solvent action of the H-ion destroys the gelatinous structure, and the denser granular modification which forms

loses water and darkens less readily than the looser gelatinous mass.

The formation of inorganic jellies: arsenates: HARRY B. WEISER and ALLEN P. BLOXSOM. Grimaux has shown that the dialysis of a colloidal solution of ferric arsenate peptized by ferric chloride results in the formation of a jelly. This has been confirmed by Holmes. The latter finds that the dialysis removes acid and points out that the same result may be obtained by decreasing the H-ion concentration by allowing ammonia or sodium acetate to diffuse through parchment into the colloid. Ferric arsenate peptized by ferric chloride or HCl gives a positive colloid stabilized by preferential adsorption of hydrogen ion. Dialysis lowers the concentration of the peptizing agent below the critical value so that slow coagulation takes place—an important condition for the formation of a stable jelly. The same result may be obtained by suitable addition of an electrolyte having a strongly adsorbed anion. The important thing is to neutralize the adsorbed H-ion which gives the colloid its stability rather than to cut down the actual H-ion concentration in the solution, as Holmes implies. This is established by the observation that jellies are formed by the coagulation of positive colloidal ferric arsenate with acids, such as H_2SO_4 and H_3PO_4, H_2CrO_4 and citric and by any number of so-called neutral salts. Similar results were obtained with ferric arsenate colloids stabilized by hydroxyl ion and with colloids of other arsenates. The results are in accord with the author's general theory of the formation of inorganic jellies.

The viscosity of gelatin solutions: theoretical considerations (lantern): STERNE MORSE.

The viscosity of gelatin solutions: the influence of electrolytes (lantern): STERNE MORSE. (1) If the fluidity of a mixture is taken to be an additive function of the fluidities of the components when the latter are taken in terms of their molecular concentrations, and if it is assumed that there exists in a gelatin solution containing a salt two forms of the dissolved gelatin, differing in viscosity, the one reacting reversibly with the salt to form the other, an equation can be derived from these assumptions which satisfactorily fits the observed data. This equation has the form:

$$x^n = k\,\frac{a - v}{v - b}$$

where v is the observed viscosity of the system, x is the concentration of the salt, and n, k, a and b are constants. a is nearly equal to the limiting value of v where the amount of electrolyte approaches o and b is nearly equal to its limiting value where the amount of electrolyte is made large. The equation is only valid where the hydrogen ion concentration does not change. (2) If the hydrogen ion concentration changes all these constants change for a given salt. The constant a is shown to vary according to the empirical equation:

$$\frac{(p^H - p)'}{c} = (A - a)^n - k$$

where c, n, A and k are constants and where p is a constant, nearly equal to 3.0. (3) The viscosity of water is shown not to enter into the above equation if the amount of free water remains constant or is very small. The hypothesis is therefore advanced that the amount of free water in systems of this nature is very small as the preferable alternative. This is held to explain the very large effect of the presence of gelatin on the viscosity of its solutions. (4) The constants of the first equation are shown to exhibit *maxima* or *minima* in the neighborhood of the hydrogen ion concentration, $p^H = 3.0$. The importance of this point of acidity is further shown by the fact that the value of p in the second equation is usually or always in this neighborhood. (5) The limiting value of the viscosity in the presence of large concentrations of salts is dependent on the value of the cation in acid solutions, and for the salts tested appears to follow the ability of the cation to associate water.

Experiments on the swelling of ash-free gelatin: S. E. SHEPPARD, FELIX A. ELLIOTT AND ANBER J. BENEDICT. Two phases of the swelling of ash-free gelatin have been investigated conjointly; the effect of variations in the hydrogen ion concentration on swelling, with the effect of previous treatment on swelling. It was found that in ash-free gelatin swollen in buffered solutions of varying p_H's at 7°C. a minimum swelling takes place over a region centered at p_H 4.8, or the iso-electric point of gelatin, and swelling increases both with increasing and decreasing hydrogen ion concentration. This is in disagreement with Wilson and Kern, who found a second minimum at $p_H = 8$. It is believed that their observations may have been due to the presence of (1) other proteins not present in ash-free gelatin or (2) the presence of ash, *i.e.*, inorganic salts combined or otherwise. Experiments have also been made with sheets of gelatin of varying thicknesses dried from a solution of given concentration and with sheets of uniform thickness dried from solutions of varying concentrations. The results establish a definite effect of these factors on the swelling limit, which indicates that modifications of the Proctor-Wilson-Loeb theory of swelling are necessary.

Note on formation of a carbon gel in tar: S. E. SHEPPARD and L. W. EBERLIN. In the course of development of colloidal fuels considerable quantities of the residual "pressure still" tar from Burton stills was obtained and used. This residuum had the following properties: viscosity Engler, 7.3 at 20°C.; flash point, 290° F.; asphaltum, 4.6 per cent.; free carbon, 1.0 per cent. These figures are representative, the values fluctuating with different lots. The point of interest in the present connection is the behavior of the "free" carbon. This is present in the original tar as submicroscopic particles, which on dilution with benzine show for some time lively Brownian movement. There is some tendency on prolonged standing for the asphalt and carbon to sludge, but what is more remarkable is that on standing for a year or more—in the present case examination was made after three years—the "free" carbon had aggregated to form a semi-rigid gel, uniformly dispersed throughout the oil, although starting at the bottom and sides. The whole gel was easily broken up mechanically, but had a distinctly "gritty" feel; it appears evident that this slow coking produces a product similar in character to the normal petroleum coke from the still, but in this case gradually built up. The faculty of carbon atoms of building up chains and networks, postulated by I. Langmuir in connection with the structure of adsorbent chars, seems well demonstrated here. Protective colloids delayed but did not entirely prevent this carbon gel formation. Analyses for free carbon did not show any noteworthy increase in its amount.

The preparation of highly absorbent gels: HARRY N. HOLMES and J. ARTHUR HENDERSON. The authors slowly added a solution of ferric chloride to a water glass solution (very definite volumes and concentration). The deep yellow gelatinous precipitate was washed, dried, then activated at 145°. At 30° it absorbed 31 per cent. of its own weight of benzene from a stream of air saturated with benzene. A precipitate dried at 50° until hard before washing gave a gel of 43.1 per cent. absorptive power. A similar gel dried hard and then soaked with dilute HCl to convert the iron oxide into chloride was washed and activated. It adsorbed 49.3 per cent. benzene. This was white silica gel. The product purchased from the Silica Gel Corporation adsorbed 33 per cent. benzene.

Adsorption by activated carbon—theory of hydrolytic adsorption: F. E. BARTELL and E. J. MILLER. From our work on adsorption of electrolytes by activated carbon, we have been led to the view that the adsorption is hydrolytic in nature. The theory of adsorption is based upon recent work of Bragg and Bragg on crystal structure and work of Langmuir and Harkins on orientation of molecules in liquid surfaces. Solid carbon is assumed to have a crystal lattice resulting in adsorption points. Through the operation of residual forces from these points hydroxyl and hydrogen radicals are adsorbed; the former may be displaced by almost any anion, the latter only by cations of metals more electropositive than hydrogen. Radicals containing carbon groups readily displace H or OH radicals, *i.e.,* they are readily adsorbed. Introduction of CH_2 groups. Additions of polar groups as COOH, OH, $CONH_2$ decreases the adsorption. This theory accounts for the results obtained in the adsorption of acid and basic dyes by charcoal.

The adsorption of ammonia by metals: HUGH S. TAYLOR, ARTHUR F. BENTON and WALTER A. DEW. Ammonia is reversibly adsorbed by copper to a large extent in the temperature region 0°—218°C. It is adsorbed by iron, largely irreversibly, hydrogen first predominating and then nitrogen being pumped off on heating the iron-ammonia complex. With sodium, as is well known, sodamide is formed, doubtless preceded by a $Na\text{-}NH_3$ complex. The bearing of these observations on contact catalysis, on specificity of catalytic action and on catalytic mechanism in the light of newer theories of atomic and molecular structure will be discussed.

A quantitative study of the effect of the hydrogen-ion concentration in electric-endosmose work: J. W. ELDER and NEIL E. GORDON. A quantitative study of electric-endosmose was taken up with aqueous solutions of varying hydrogen-ion concentration, using silica gel as the membrane. It was found that the change of the charge on the membrane had nothing in common with the neutral point. The relation of the charge on the gel to the p_H value of the solution was also studied in the presence of salts, and the cation and anion effects noted.

Plasticity in colloid control: EUGENE C. BINGHAM and ALFRED G. JACQUES. The concentration of zero yield value and the concentration of zero mobility are characteristic properties in non-polar colloids, which are closely connected with the size and shape of the colloidal particles. Both of these properties are found to be independent of the fluidity of the medium. The effect of small percentages of impurities as well as the length of time in grinding in the process of mixing have been measured.

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